

Modeling Recreation Pressure on Idaho Forest Lands

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As part of the State Assessment of Forest Resources, an estimate of the amount of use or pressure put on forested lands by recreational users was modeled using GIS techniques. Assessing recreation pressure for individual endowment parcels would allow analysts to systematically identify those areas potentially experiencing higher use due to proximity to population centers. This model employed population data from the US Census and travel preference survey results and Off Highway Vehicle (OHV) registration information supplied by the Idaho Department of Parks & Recreation. The assumptions, data and methods which make up the recreation pressure model are described below.

Assumptions

A number of simplifying assumptions guided the model development:

- Census population can be used as a surrogate for overall recreation pressure
- OHV registration totals by county can be used to estimate motorized recreation pressure
- The public road network is how recreation pressure is transmitted and dispersed to forested lands
- Recreation pressure comes primarily from urban population centers within and outside the state:
 1. Boise/Nampa/Caldwell
 2. Twin Falls
 3. Pocatello
 4. Ogden/Layton, UT
 5. Logan, UT
 6. Idaho Falls
 7. Moscow, ID/Pullman, WA
 8. Clarkston, WA/Lewiston, ID
 9. Spokane, WA/Coeur d'Alene, ID
- Recreation pressure on a forestland can come from multiple population centers and is additive
- Recreation pressure decreases as travel time to a recreation destination increases (actually, not an assumption but confirmed by IDPR recreation demand surveys)
- All parts of the state are equally desirable recreation destinations and certain destinations (such as resort areas, parks, etc.) do not attract more recreation pressure than others
- Recreation activity is defined as that which lasts a day or less; multi-day recreation activities are not considered

Data

- U.S. Census Urbanized Areas representing the Census 2000 Urbanized Areas (UA) and Urban Clusters (UC); reformatted by ESRI and included in their ESRI Data & Maps DVD distribution for 2006.

- 2006 Off Highway Vehicle registrations by county supplied by the Idaho Department of Parks & Recreation
- Travel distance preferences from 2002 Recreation Demand Assessment by Idaho Department of Parks & Recreation
- Roads from StreetMap USA, a TIGER 2000-based streets dataset enhanced by ESRI and Tele Atlas and provided in the ESRI Data & Maps DVD distribution for 2006.

Methods

The question the model needed to answer was: how much and where is the pressure put on forested lands by recreation users? In order to answer that question two more basic questions first needed to be answered:

- How long does it take to get from a population center to a forested area (AKA travel time)?
- How does recreation pressure decrease as travel time increases?

In order to determine travel time, a raster GIS modeling technique was used known as least cost modeling. It solves the problem of determining the shortest weighted distance (or least accumulated travel cost) from each location to the nearest source location. For example, it may be shorter to climb over the mountain to the destination, but it is faster and thus less costly to walk along the road around it. In our case the source locations were really the urban population centers and travel time (in terms of the accumulated cost or the time it takes to travel there) was computed from these locations to all other parts of the model landscape.

The two key inputs to this technique are the source location(s) and the cost surface. Urbanized area polygons were extracted from the ESRI/Census dataset and broken out into ten source location layers, one for each urban area. The cost surface (represented as a raster or cell-based dataset) was defined as the public road network and all other non-roaded areas. The values for the cost surface were defined as the time it takes to traverse one cell or spatial unit. For this model, a 100 meter cell size was used based upon a need to balance precision of the cost estimate with the size of a statewide dataset. Travel times to traverse a single cell were computed based upon whether that cell represented a road or not. Travel times for road cells were tied to speed limits deduced from road class data in the roads layer. These were converted from miles/hour to seconds/meter in order to align with the horizontal units of measure for the cost layer and also to translate between elapsed distance per unit time (miles /hour) and elapsed time per unit distance (seconds/meter). Off-road (i.e. all parts of the cost surface not covered by roads) travel times were computed to be walking speed to correctly reflect the cost a person would incur if they needed to walk across a non-roaded piece of ground.

Once these inputs were developed travel time surfaces were created using the cost distance modeling tools in ArcGIS. This was computed for each source or individual urban area. Travel times at threshold values were extracted from the continuous travel time surfaces, converted to polygonal areas, attributed with their respective source urban area population totals and treated as individual recreation pressure layers. Travel times of 1, 2, and 3 hours were used for the thresholds based in part on the IDPR recreation demand survey data. In order to account for the additive effects of overlapping recreation

pressure from multiple urban areas, all individual recreation pressure layers for a given travel time threshold were then added together to develop a single recreation pressure layer for a given travel time threshold.

The 2002 IDPR recreation demand survey included information on how far people would be willing to travel for a recreational activity that takes less than a day. Using those survey results we computed recreation pressure attenuation rates; or in other words, percentages of recreational users who would travel 1, 2 and 3 or more hours. These attenuation rates were used as weights which were applied to the recreation pressure layers. These rates effectively reduced the total population or pressure as travel times increased. A total recreation pressure layer was then calculated by summing the 1, 2 and 3 hour layers.

Maps were created using four breakpoints showing low, low-medium, medium-high and high recreation pressure for the 2 hour travel time. Two hour travel time was chosen to represent a typical picture of recreation pressure.

OHV recreation pressure was modeled in an almost identical fashion with the exception that urban area population was replaced by OHV registration totals for those counties which corresponded to the urban areas. Again, 2-hour travel time was used for the final map although 1, 3 hour and total summed recreation pressure layers were also created. Although the recreation pressure map includes non-forested lands, the final map incorporating all the State Assessment of Forest Resources issue layers will have non-forested lands (except cities) masked out.